

the net are three pneumatic pressure shock wave devices 68, 70 and 72. Two additional shock wave devices 74 and 76 are mounted directly from the trawler 62. The electrical and pneumatic connections to the shock wave devices are as indicated in FIG. 1. Thus, each shock wave device has an individual electrical control so that they may be actuated upon signal from the electrical control unit within the trawler.

In purse seine fishing, the fish often escape under the boat or around the bottom edge of the net. There is usually a critical period before the purse seine net is closed when the fish are most likely to escape from the body of water enclosed by the net into the main body of ocean water. By energizing the shock wave devices deep in the water and under the boat at this critical time, the fish are scared up toward the surface of the ocean and away from the boat. Rising bubbles from the air discharge form a bubble curtain to further effectively prevent escape of the fish. This permits the fishermen to close the net without substantial loss of fish.

FIGS. 3 and 4 indicate schematically the procedure which is involved in the use of the system in accordance with the present invention. Details of purse seine fishing per se are well known in the art and are not shown or discussed in detail. In general, FIG. 3 shows a row-boat or large float 82 located at the end of the net. The upper edge of the net is supported at the surface of the water by a series of floats 84. After the trawler completes the circle, the net is closed around the school of fish by suitable ropes and cables (not shown) in accordance with well-known techniques in the fishing industry.

In the use of the pneumatic shock wave devices in fishing, it is sometimes useful to raise and lower them so that they may be actuated below the school of fish and scare them upward into the confines of the net. A reel 86, mounted on the deck of the trawler 62, may be employed to raise or lower one of the shock wave devices 76. Separate pneumatic and electrical leads may be provided to the shock wave device 76. Alternatively, a single cable with suitable electrical and pneumatic connections through the reel 86 may be employed.

The other pneumatic shock wave devices 68, 70, 72 and 74 may also be raised and lowered by lines, pulleys, and other mechanical devices; however, this will normally not be necessary in view of their locations at the periphery of the net (for devices 68, 70 and 72) and under the trawler (for unit 74). The facility for vertical positioning of the unit 76 through the use of the winch or reel 86 is most useful in preventing escape of the fish in the course of closing the net. While the other units would normally be adequate for this purpose, the presence of the vertically adjustable unit 76 completes the system and makes it virtually foolproof.

With regard to the pneumatic shock wave production system of FIG. 1, individual units are known per se. However, the present invention involves the use of one or more pneumatic shock wave devices in the catching of fish, or, more generally, in controlling the movement of marine life through the use of such devices. Accordingly, it will be appreciated that the shock wave devices may take forms other than that shown in FIG. 1. However, it is desirable that the pneumatic devices have a high initial shock wave front, or impulse, as this seems to have an unusually good effect in scaring or restraining fish from escape.

While the use of strong sound sources and particularly of devices for suddenly discharging high-pressure air into the water has been illustrated in terms of purse seine fishing, the present invention encompasses the broad concept of controlling the movement of marine life through the use of such devices. For example, the present methods may be effectively used in preventing exit of fresh water fish from stocked lakes, in preventing entry of fish into spillways or turbine intakes, or in tagging and fish census operations.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Numerous other arrangements within the scope of the invention may be devised by those skilled in the art. Thus, by way of example and not of limitation, other pneumatic shock wave producing devices may be employed; other pneumatically actuated devices to simultaneously produce a loud clanking, whistling or other sounds and also discharge bubbles into the water may be used; and pneumatic rather than electrical triggering may be used. Accordingly, from the foregoing, it is evident that various changes may be made in the present invention without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A method of preventing movement of aquatic organisms in a body of water toward a prohibited region thereof comprising:

placing at least one pneumatic shock wave generating device in said body of water between said prohibited region and said aquatic organisms; and

actuating said device to explosively release high pressure gas, thereby producing a shock wave in said body of water rising to an initial pressure peak within five milliseconds and propagating at high velocity.

2. In the method of claim 1,

confining said aquatic organisms in said body of water with an obstruction having an opening communicating with said prohibited region thereof;

said shock wave generating device being placed at said opening; and

in which said shock wave generating device is actuated pneumatically to produce said shock wave, thus diverting said aquatic organisms from said opening.

3. In the method of claim 1,

confining said aquatic organisms in said body of water with a barrier having an opening communicating with said prohibited region thereof;

a plurality of said shock wave generating devices being placed about said opening; and

in which said plurality of shock wave generating devices are actuated pneumatically to produce a plurality of said shock waves at said opening, thus diverting said aquatic organisms from said opening.

4. In the method of claim 1,

confining said aquatic organisms in said body of water within an enclosure having an opening communicating with said prohibited region thereof;

a plurality of said shock wave generating devices being placed about said opening; and

in which said plurality of shock wave generating devices are actuated pneumatically to produce a plurality of said shock waves at said opening, thus diverting said aquatic organisms from said opening.

5. In the method of claim 1,

said pneumatic shock wave generating device being placed adjacent the opening in a net barrier;

surrounding a plurality of said aquatic organisms with said net barrier; and

in which said pneumatic shock wave generating device is pneumatically actuated to divert said aquatic organisms in said net from said opening.

6. In the method of claim 1,

a plurality of said pneumatic shock wave generating devices being placed about an opening in a net barrier; surrounding a plurality of said aquatic organisms with said net barrier and gradually closing the opening in said net barrier; and

in which said pneumatic shock wave generating devices are actuated pneumatically to generate said shock waves and divert said aquatic organisms away from said opening in said net barrier.

7. In the method of claim 1,

a plurality of said pneumatic shock wave generating